ENSR

Platteville Aquifer Northern Area Feasibility Study for the Reilly Tar & Chemical Corporation N.P.L. Site, St. Louis Park, Minnesota

ENSR Consulting and Engineering

March 1994

Document Number 1620-013-300

CITY OF ST. LOUIS PARK

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

March 14, 1994

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President
Reilly Industries, Inc.
1510 Market Square Center
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Indianapolis, Indiana 46204

RE: United States of America, et al. vs. Reilly Tar & Chemical Corporation, et al.
File No. Civ. 4-80-469

Gentlemen:

In accordance with the provisions of Section 9.4 of the Remedial Action Plan (RAP) in the referenced case, enclosed is a revised "Platteville Aquifer Northern Area Feasibility Study (FS)". The submittal is presented in response to a December 23, 1993, Agency letter wherein a number of issues were raised and direction to resubmit the FS was issued. The revised FS provides an evaluation of three remedial alternatives and is therefore responsive to the Agency's comments on the Draft FS. Pumping rates, well locations, and capture zones are discussed. Alternative technologies including slurry walls, bioremediation (air spraying) and barrier wells are also discussed in the revised FS.

The balance of this letter responds to the various issues identified in the Agency letter of December 23. To assist the reader, the Agency's comments/issues are printed in bold type and the City's response is presented in normal type.

MPCA Comment Section 1.1

Background and Site History, Figure 1, Site Location is missing from the Report.

Figure 1 is now included in the report.

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MPCA Comment Section 2.0

Detailed Analysis, rejects the no action alternative and discusses the problem of heterogeneous transmissivity in the Platteville Aquifer. It acknowledges the recommendation made in the Draft Platteville Technical Memorandum to utilize W434 as a gradient control well while commenting that since W434 is located outside the Northern Area, it will not prevent the spread of contamination located within the Northern Area. This section also states that no "reasonable" combination of pumping wells exists that can be expected to exert complete control over the Northern Area, and no reasonable groundwater monitoring network exists to assess the effectiveness of pumping wells in the Northern Area. The remainder of the report is an evaluation of a "generic" gradient control option. This is not a detailed analysis of the gradient control option. No combination of pumping wells and monitoring points is proposed or evaluated. Possible gradient control options should be presented and evaluated in this section of the report.

The revised FS presents and evaluates gradient control options. One option involves pumping well W434 to mitigate the impact of the further spread of contamination in the Northern Area. The other option evaluated in the revised FS is pumping at four locations in the eastern portion of the Northern Area. Because only partial effectiveness is achieved by pumping the four wells within the Northern Area, and the resulting benefit is uncertain, no other options for combined pumping both inside and outside the Northern Area were evaluated.

MPCA Comment Section 2.1

Overall Protection, states that no human health risks have been associated with contamination in the Northern Area of the Platteville Aquifer, and that no drinking water wells are completed in the aquifer. St. Louis Park municipal well #3 is a multi-aquifer well open to the Platteville, St. Peter, and Prairie Du Chien - Jordan aquifers. A well search completed by Hickok in 1983 discovered many domestic and commercial wells open to the Platteville in the area.

The Drift Platteville Aquifer system has not been used as a reliable drinking water source since the early 1960s when nitrate contamination from septic discharge was identified. (L. Woodward, 1961. *Groundwater Contamination in the Minneapolis and St. Paul Suburbs*. Proceedings of 1961 Symposium on Groundwater Contamination and Mogg, 1962, *Interpretation of Pumping Test Anomalies*, Journal of the Hydraulics Division, November

1962). St. Louis Park municipal well #3 (SLP3) is not completed in the Platteville Aquifer, therefore it remains true that no drinking water wells are completed in the aquifer. In fact, during a 1962 pump test, it was determined that essentially all of the water pumped at SLP3 is derived from the St. Peter Aquifer and that none was derived from the Platteville Aquifer (Mogg, 1962). Furthermore, the City plans to recase SLP3 in the coming year so that it will only be open to the St. Peter Aquifer. The many domestic and commercial wells open to the Platteville Aquifer similarly derive water from other aquifers due to the low transmissivity of the Platteville Aquifer in the Northern Area. Also, the municipal supply provided by the City is used exclusively for drinking water in the area. The only known private water well use is for irrigation purposes.

MPCA Comment Section 2.2

Compliance with ARARs, again states that the Platteville Aquifer is not used as a source of drinking water. This is not the case because SLP3 is open to the Platteville Aquifer, and contaminated groundwater from the Platteville may be entering the lower aquifers from which SLP3 is pumping. Therefore, the statement that the surface water criteria may be used to assess the need for groundwater control measures should be removed. The CD/RAP, Section 2.2 states that the Drinking Water Criteria shall apply to groundwater which is monitored as required by the RAP. Section 2.2 alone is sufficient reason to apply Drinking Water Criteria and coupled with the possibility of the Platteville Aquifer contaminating lower drinking water aquifers, the application of Drinking Water Criteria is appropriate.

The analytical results for SLP3 samples indicate that no contamination of any kind exists, or has ever existed in the water derived from that well. Well SLP3 is not in the Northern Area, and is outside the inferred area of contamination in the Platteville Aquifer. Therefore, contaminated groundwater from the Platteville Aquifer is not entering the lower aquifers from which SLP3 is pumping.

ARARs are discussed in the revised FS. Discussions of more appropriate water quality criteria that will be applicable to the Platteville Aquifer remedy, will be conducted in the future. Such discussions will be based on alternate polynuclear aromatic hydrocarbon (PAH) criteria provided by the Unites State Environmental Protection Agency (U.S. EPA) and the Minnesota Department of Health (MDH) in the form of maximum concentration limits and health risk limits for PAH in groundwater.

MPCA Comment Section 2.7

Costs, includes only costs for pumping W434. No costs for additional gradient control wells are included.

This comment is addressed in the FS.

Questions/comments regarding the submittal and the content of this letter may be directed to this office.

Sincerely,

James N. Grube

James N. Grube
Director of Public Works

cc: Elizabeth Thompson (w/o encl)
Bill Gregg (w/2 encl)
Reilly File (w/encl)

Platteville Aquifer Northern Area Feasibility Study for the Reilly Tar & Chemical Corporation N.P.L. Site, St. Louis Park, Minnesota

ENSR Consulting and Engineering

March 1994

Document Number 1620-013-300

PLATTEVILLE AQUIFER NORTHERN AREA FEASIBILITY STUDY
FOR THE REILLY TAR & CHEMICAL CORPORATION
N.P.L. SITE, ST. LOUIS PARK, MINNESOTA

SUBMITTED TO THE

REGIONAL ADMINISTRATOR
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

EXECUTIVE DIRECTOR
MINNESOTA POLLUTION CONTROL AGENCY

BY

THE CITY OF ST. LOUIS PARK, MINNESOTA

PURSUANT TO
CONSENT DECREE - REMEDIAL ACTION PLAN
SECTION 9.4

UNITED STATES OF AMERICA, ET AL.

vs.

REILLY TAR AND CHEMICAL CORPORATION, ET AL.

UNITED STATES DISTRICT COURT
DISTRICT OF MINNESOTA
CIVIL NO. 4-80-469

SUBMITTED MARCH 14, 1994

1.0 INTRODUCTION

1.1 Purpose and Organization of Report

The purpose of this Feasibility Study (FS) is to evaluate remedial alternatives for the Northern Area of the Platteville Aquifer. This FS is designed to demonstrate that the remedy selection requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) are being satisfied (U.S. Environmental Protection Agency, 1988).

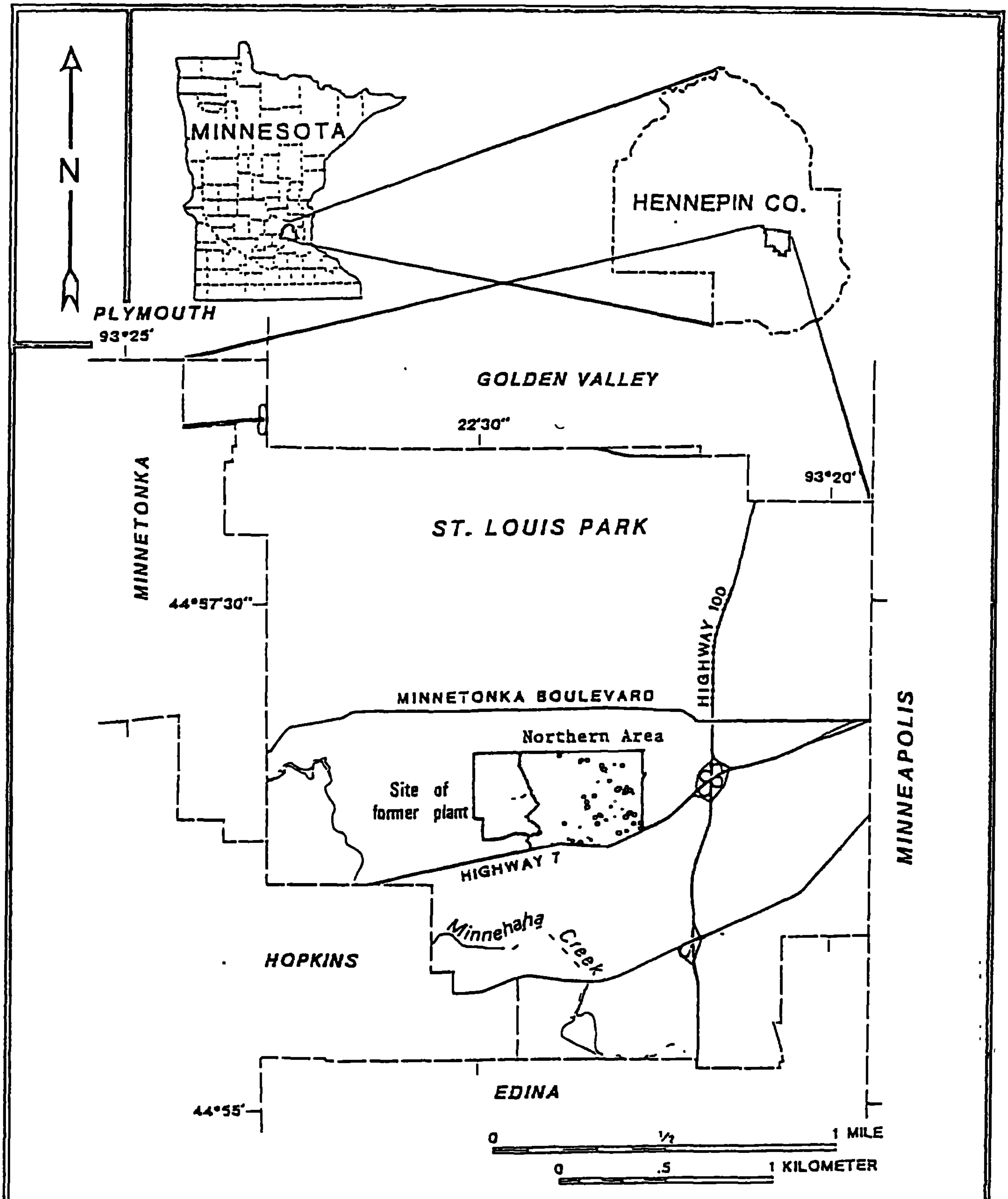
The activities described in this report are intended to address a limited element of the overall contamination problem at and around the former Reilly Tar and Chemical Corp (Reilly) Site (Site) in St. Louis Park, Minnesota (Figure 1).

The remainder of Section 1.0 presents the Site background and history, and remedial action objectives. Remedial technologies are identified and evaluated in Section 2.0, to screen out those technologies that are not applicable due to technical limitations. Those technologies surviving the screening are then used to develop remedial alternatives in Section 3.0. These alternatives also undergo a detailed analysis in Section 3.0. The recommended remedial alternative is presented in Section 4.0 along with a conceptual design of this Alternative.

1.2 Background and Site History

Between 1917 and 1972, Reilly operated a coal tar distillation and wood preserving plant, known as the Republic Creosote Company. Wastewater from plant operations was discharged to ditches which drained to a swamp south of the Site. Additional releases of creosote and coal tar resulted from drippings and spills onto the soil. The major constituents of coal tar are phenolic compounds and polynuclear aromatic hydrocarbons (PAHs). Some PAH compounds are carcinogenic and are of concern when a source of drinking water is contaminated with these compounds. As used here, "contaminated" or "contamination" means PAH or phenolics in the soil or ground water resulting from activities of Reilly at the Site.

Because of extensive residential development in the area around the Site in the 1940s and into the 1950s, complaints about shallow well contamination and odor problems became a problem. As a result of the continuing problems with air emissions, and soil and surface water contamination, the City of St. Louis Park (City) and the Minnesota Pollution Control Agency (MPCA) filed suit against Reilly in 1970. In 1972, the City purchased the Site from Reilly and the plant was dismantled and removed. The City dropped its lawsuit against Reilly as a condition



Source: USGS, 1967. Hopkins and Minneapolis South, MN Quadrangle Maps. Photorevised 1972.

Figure 1
Site Location
St. Louis Park, MN

DRAWN: RBG | DATE: 6-24-91 | PRJ. NO.: 1620-007 of the sale. The MPCA did not drop its suit, which was eventually dismissed as part of a comprehensive settlement in 1986.

Louisiana Avenue was constructed through the Site and multi-family housing units were constructed in the northern half of the Site during the mid-1970s. In 1978, the Minnesota Department of Health (MDH) began to analyze water from municipal wells in St. Louis Park and nearby communities for trace concentrations of PAH. The analysis program discovered unexpectedly high concentrations of PAH in six City wells and one well in neighboring Hopkins, causing the wells to be closed between the years 1978 and 1981.

After it was determined that ground water contamination had occurred, the State amended, in 1978, its complaint in the lawsuit with Reilly to include claims for ground water contamination. Subsequent legal actions were taken by the federal and state governmental agencies against Reilly under the Resource Conservation Recovery Act (RCRA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and the Minnesota Environmental Response and Liability Act (MERLA). Both the U.S. Environmental Protection Agency (U.S. EPA) and the MPCA instituted administrative actions against Reilly, pursuant to the respective federal and state Superfund acts, in order to compel Reilly to undertake necessary remedial actions. Following the administrative actions, negotiations which had previously broken down resumed between the U.S. EPA, MPCA, City, and Reilly. General agreement was reached in the summer of 1985. However, because of the complex nature of the agreement and the number of parties involved, the effective date of the final agreement was delayed until September 4, 1986. This agreement is embodied in the Consent Decree - Remedial Action Plan (CD-RAP).

1.3 Requirements of the Legal Settlement

Section 9 of the CD-RAP specifies the installation and operation of one or more gradient control wells to prevent the further spread of ground water in the Northern Area of the Platteville Aquifer exceeding any of the drinking water criteria defined in CD-RAP Section 2.2. (A gradient control well is a pumping well that intercepts ground water flow coming from upgradient of the well. Thus, operation of a gradient control well placed downgradient of a contaminant source can act to capture the flow from the source and limit the spread of contamination.) As such, the CD-RAP provides the objective of the remedial action, as well as a mandate to the Potentially Responsible Parties to control the gradient in the Northern Area of the Platteville Aquifer. Therefore, this FS builds on previous evaluations to develop and screen alternatives that were analyzed during various studies referenced in the CD-RAP. In addition, this FS considers MPCA comments on the Draft FS (submitted on May 20, 1992) as presented in its December 23, 1993, letter to the City of St. Louis Park and Reilly.

In accordance with the remedial action objective stated in the CD-RAP, this FS is specific to ground water in the Northern Area of the Platteville Aquifer and is not a site-wide FS. The Northern Area of the Platteville Aquifer remedial action will operate independently of other remedial actions required by the CD-RAP for the purpose of preventing the further spread of contamination. Remedial actions taken at other areas of the Reilly Site may, however, influence the duration of this alternative. For example, sealing multi-aquifer wells, operating source and gradient control wells in other aquifers, providing treated drinking water, and continuing to monitor ground water quality may affect the operation of gradient control wells to varying degrees.

1.4 Remedial Action Objectives

Applicable or relevant and appropriate requirements for this alternative are defined in the CD-RAP, Sections 2.2 and 2.5:

DRINKING WATER CRITERIA

Parameter	Advisory Level	Drinking Water Criterion
The sum of benzo(a)pyrene and dibenz(a,h)anthracene	3.0 ng/l*	5.6 ng/l*
Carcinogenic PAH	15 ng/l	28 ng/l
Other PAH	175 ug/l	280 ng/l

*Or the lowest concentration that can be quantified, whichever is greater.

Since drinking water criteria for PAHs were not developed through the Safe Drinking Water Act regulations, it was necessary to develop these criteria for PAH compounds. This was accomplished through consultations with experts, MDH, MPCA, and U.S. EPA Drinking Water Program representatives (U.S. EPA, 1986). The drinking water criteria for carcinogenic PAH represents a risk level of 10^{-6}. The Platteville Aquifer is not used as a source of drinking water in the Northern Area of St. Louis Park and likely not in surrounding communities.

The Clean Water Act (CWA) and the regulations under it are applicable to the proposed remedial activities with respect to the discharge of extracted ground water, or contaminated surface water from the Site, to either the surface waters or the sanitary sewers. The CWA and its regulations set forth permitting requirements for point source discharges that implement minimum treatment technology standards and protect the quality of the receiving water. The conditions in the CD-RAP are intended to require full compliance with the CWA with regard to National Pollutant Discharge Elimination System (NPDES) permitting and pretreatment requirements.

The operation of the Platteville Aquifer gradient control well(s) will be governed by the use of these ARARs or other limits established by the Agencies. The Platteville Aquifer has the beneficial use of recharging surface water, therefore, the surface water criteria may be used to assess the need for ground water control measures and discharge options for ground water that is removed.

SURFACE WATER CRITERIA

Parameter	Daily Maximum Concentration	30-Day Average Concentration
Carcinogenic PAH	–	65 ng/l
Other PAH	34 ug/l	17 ug/l
Phenanthrene	2 ug/l	1 ug/l
Phenols	–	10 ug/l

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 Introduction

The purpose of this section is to document the development of remedial alternatives. A list of technology types and process options is presented. Those technology types or process options not applicable to the Site are screened out and not considered for further evaluation. Those technologies and process options that are potentially applicable are then assembled into remedial alternatives.

2.2 Screening of Remedial Technologies

Remedial technology types and specific process options for ground water in the Platteville Aquifer Northern Area as listed in Table 2-1. Each of these technologies is evaluated below based on technical feasibility and implementability. Summary comments of the evaluation are included on Table 2-1, as well as an indication of whether the technology was screened out or retained for further evaluation.

2.2.1 No Action

No action is a baseline to which other remedial technologies can be compared. It is included as required by the National Contingency Plan (NCP).

2.2.2 Ground Water Monitoring

Ground water monitoring will be included as part of all remedial alternatives developed. It is necessary for tracking the presence and movement of contaminants in ground water, as well as for assessing the effectiveness of remedial alternatives. Although the limited and heterogeneous transmissibility of the aquifer limits the effectiveness of ground water monitoring in achieving these goals, it is included as part of each alternative.

2.2.3 Barrier Wells

Barrier wells are ground water extraction wells that would be installed around the perimeter of the Northern Area to form a hydrologic barrier to ground water flowing into and out of the Platteville Aquifer in the area. The technical effectiveness of this technology would be limited by the low transmissivity of the aquifer. The number of wells that would have to be installed to form

TABLE 2-1

Initial Technology Screening
Platteville Aquifer Northern Area
Reilly Tar and Chemical Corporation NPL Site, St. Louis Park, Minnesota

Technology Type	Process Option	Description	Screening Comments	Selected for Alternative Assembly?
No Action	No Action	No Action	Required for consideration by NCP.	Yes
Groundwater Monitoring	Groundwater Monitoring	Sampling of groundwater monitoring wells to track concentrations of compounds.	Will be included as part of each remedial alternative.	Yes
Containment	Barrier Wells	Groundwater extracted through wells installed around the perimeter of the Northern Area to prevent movement of contaminants in Northern Area.	The number of wells required would be impractical due to the limited transmissivity of the aquifer.	No
	Gradient Control Wells	Groundwater extracted through wells installed at the downgradient (east) portion of the Northern Area to prevent migration of contaminants from the northern area.	Wells could be installed to attempt to prevent migration of contaminants from the Northern Area.	Yes
	Slurry Wall	Vertical trench excavated under a slurry and backfilled with a soil/bentonite mixture to form a barrier to groundwater flow in unconsolidated materials.	Slurry walls are not applicable to bedrock aquifers such as the Platteville Aquifer.	No
Removal	Groundwater Extraction Well(s)	Groundwater extracted through wells and to remove contaminants from aquifer.	Removal of groundwater through extraction well W434 would prevent contaminants from migrating from the northern area to the area of the bedrock valley.	Yes

TABLE 2-1

Initial Technology Screening
Platteville Aquifer Northern Area
Reilly Tar and Chemical Corporation NPL Site, St. Louis Park, Minnesota

Technology Type	Process Option	Description	Screening Comments	Selected for Alternative Assembly?
Treatment	Carbon Adsorption	Extracted groundwater pumped through activated carbon to resource contaminants prior to discharge.	Treatment of extracted groundwater may be required prior to discharge to storm sewer or surface water. The need for treatment would be evaluated after the groundwater pumping wells have been in operation for a period of time that would allow contaminant concentrations to stabilize.	Yes
In-Situ Treatment	In-Situ Bioremediation	Injection of nutrients and oxygen into the aquifer to stimulate indigenous micro-organisms to degrade contaminants.	Bioremediation is not capable of reducing contaminant levels to the parts per billion range. The physical nature and limited transmissivity of the aquifer would limit the effectiveness of transferring nutrients and oxygen to the entire aquifer.	No
Disposal	Discharge to POTW	Discharge of extracted groundwater through sanitary sewer to Publicly Operated Treatment Works (POTW), in this case, a Metropolitan Waste Control Commission (MWCC) facility, for treatment.	Initial discharge of groundwater would be routed to MWCC, until ability to meet surface water discharge criteria is demonstrated.	Yes
	Discharge to Surface Water	Discharge of extracted groundwater to surface water via storm sewers.	After demonstrating ability to achieve surface water discharge criteria (possibly requiring carbon adsorption treatment), groundwater would be discharged to surface water.	Yes

a barrier to ground water flow would be extremely high, due to the small capture zones of the wells. For this reason, it would be extremely difficult, if not impossible, to implement this technology, especially in a fully developed residential area where land use restricts placement of wells. This technology is therefore not selected for assembly of remedial alternatives.

2.2.4 Gradient Control Wells

Gradient control wells are ground water extraction wells that would be installed in the downgradient portion of the Northern Area Platteville Aquifer (east end) to attempt to prevent contaminants from migrating from the area. As with the barrier wells, the effectiveness of this technology is limited by the low transmissivity of the aquifer. However, for the purpose of developing remedial alternatives that can be evaluated in detail and compared to each other, this technology was selected for assembly of remedial alternatives.

2.2.5 Slurry Wall

Slurry walls are vertical trenches that are excavated under a slurry and backfilled with a soil/bentonite mixture to form a barrier to ground water flow in unconsolidated materials. (USEPA, October 1985). Because the Platteville Aquifer is a bedrock aquifer, this technology is not applicable. Attempting to excavate a trench and construct a slurry wall through bedrock at depths of over 100 feet is not technically feasible. Ensuring that a hydraulic barrier was created in a fractured rock formation would also be very difficult. For these reasons, slurry walls were not selected for assembly of remedial alternatives.

2.2.6 Ground Water Extraction Wells

Ground water extraction wells are used to pump ground water from the aquifer in order to remove contaminants. Because of the low transmissivity of the aquifer, it would be technically infeasible to install a sufficient number of wells to remove contaminants to levels that would achieve cleanup levels.

However, the Draft-Platteville Northern Area Supplemental Remedial Investigation (City of St. Louis Park, 1991) identified the use of Platteville Aquifer well W434 as a pumping well to effectively intercept ground water contaminants from migrating into the area of the buried bedrock valley downgradient from the northern area. Well W434 is ideally located to protect the St. Peter Aquifer by pumping the Platteville Aquifer. In this manner, pumping well W434 will address the primary concern for limiting the further spread of contamination located in the Northern Area of the Platteville Aquifer.

Therefore, pumping of ground water extraction well W434 was selected for assembly of remedial alternatives.

2.2.7 Carbon Adsorption

Carbon adsorption is a treatment technology that uses activated carbon to remove contaminants from ground water. Ground water extracted from the aquifer through wells is pumped through beds of activated carbon and the contaminants absorb to the carbon. The contaminants are destroyed during regeneration of the carbon off Site by thermal treatment.

Carbon adsorption may be required for treatment of ground water removed from the aquifer through extraction wells prior to discharging to surface water to meet the discharge criteria. This technology is therefore selected for assembly of remedial alternatives.

2.2.8 In-Situ Bioremediation

In-Situ bioremediation consists of injecting nutrients and oxygen into the aquifer in order to stimulate indigenous micro-organisms to degrade contaminants. Ground water can also be extracted downgradient of the injection wells and reinjected upgradient. Several technical limitations exist that would make this technology not applicable to the Northern Area Platteville Aquifer.

Bioremediation is not capable of reducing contaminant concentrations to parts per billion (ppb) or parts per trillion (ppt) levels. At such low concentrations, the contaminants would not be a sufficient carbon source to support the micro-organisms. Even if a supplemental carbon source was injected into the aquifer, preferential use of the carbon source would most likely occur, especially due to the recalcitrant nature of most PAHs.

Ensuring effective transfer of nutrients and oxygen to all areas of the aquifer would be extremely difficult, given the physical nature (fractured rock) and the low transmissivity of the aquifer. Removal of ground water from the downgradient areas for possible reinjection upgradient would also be extremely difficult for the same reason. Similarly, controlling the flow of injected treatment reagents in the aquifer to prevent migration to other areas would also be difficult. Because of these technical limitations, in-situ bioremediation was not selected for assembly of remedial alternatives.

2.2.9 Discharge to POTW

Ground water removed from the aquifer through extraction wells needs to be discharged somewhere. As has been the practice in the past, ground water initially pumped from wells is discharged to the local publicly-owned treatment works (POTW), which, for the City of St. Louis Park, is a Metropolitan Waste Control Commission (MWCC) facility. Extracted ground water is pumped to a sanitary sewer, where it flows to the POTW for treatment. Although typically not a long term option, this technology is useful for initial discharges of extracted ground water. Therefore, this technology was selected for assembly of remedial alternatives.

2.2.10 Discharge to Surface Water

As stated above, ground water pumped from the aquifer requires a discharge location. Discharge to surface water, typically through a storm sewer, requires that surface water discharge criteria be achieved. In order to demonstrate compliance with these criteria, it is usually necessary to pump the well(s) for some period of time and discharge to a POTW until sampling can be completed. If extracted ground water exceeds the surface water criteria, carbon adsorption can be used to remove contaminants. Discharge to surface water is an acceptable long term discharge option. Therefore, this technology was selected for assembly of remedial alternatives.

2.3 Development of Remedial Alternatives

Table 2-1 summarizes the technology screening process. Those technologies that were selected for alternative assembly are identified in the table. Remedial alternatives were developed by combining the remedial technologies that were selected for alternative assembly. The assembly of remedial alternatives is presented in Table 2-2.

A detailed description of each alternative and the detailed analysis of the alternatives are presented in Section 3.0.

TABLE 2-2

Assembly of Remedial Alternatives
Platteville Aquifer Northern Area
Reilly Tar and Chemical Corporation NPL Site, St. Louis Park, Minnesota

Technology/Process Option	Remedial Alternatives		
	(1) No Action	(2) Gradient Control Wells	(3) Extraction Well
No Action	X		
Ground Water Monitoring	X	X	X
Gradient Control Wells		X	
Extraction Well			X
Carbon Adsorption[a]		X	X
Discharge to POTW[b]		X	X
Discharge to Surface Water[c]		X	X

a Carbon adsorption will be used only if necessary for achieving surface water criteria for discharged ground water
b Discharge of extracted ground water to POTW will be conducted initially
c Discharge of extracted ground water to surface water will be conducted after compliance with surface water discharge criteria is demonstrated

3.0 DETAILED ANALYSIS OF ALTERNATIVES

The detailed evaluation of remedial alternatives follows the development of alternatives and precedes the final selection of a remedial alternative. The results of the detailed evaluation provide the basis for identification of a preferred alternative and for preparation of a proposed remediation plan. The detailed evaluation includes:

- A detailed description of each alternative, including the various technologies that make up the alternative, any performance requirements associated with those technologies, and the logic behind application of such an alternative.

- An evaluation of each alternative against the detailed set of evaluation criteria.

- A comparative analysis of the alternatives to assess the relative performance of each alternative with respect to the detailed evaluation criteria and the conditions at the Site.

The evaluation criteria used to conduct the detailed analysis are first presented below.

3.1 Overview of Evaluation Criteria

The detailed analysis of alternatives was performed in accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (U.S. EPA 1988) and Section 300.430(e)(9) of the NCP. The purpose of the detailed analysis of alternatives is to provide decision makers with sufficient information to adequately compare the alternatives and select an appropriate remedy for the Site. The nine evaluation criteria for selection of a remedy that are outlined in Section 300.430(e)(9)(iii) of the NCP are categorized into three groups:

- **Threshold Criteria**

  - Overall protection of human health and the environment

  - Compliance with ARARs [unless a specific ARAR is waived in accordance with Section 300.430(f)(1)(ii)(c) of the NCP].

- **Primary Balancing Criteria**

  - Long-term effectiveness and permanence

- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

- **Modifying Criteria**

  - State acceptance
  - Community acceptance

The nine evaluation criteria to be used in the detailed analysis of alternatives are listed in Table 3-1. The following sections present a detailed description of each alternative and a detailed analysis, using these evaluation criteria.

3.2 Alternative 1: No Action

3.2.1 Detailed Description

This alternative consists of taking no additional action, and is included as a baseline to which other alternatives can be prepared. Periodic sampling of monitoring wells in the Platteville Aquifer Northern Area will continue.

3.2.2 Detailed Analysis

3.2.2.1 Overall Protection of Human Health and the Environment

The No Action alternative provides no additional protection of human health and the environment. However, no human health risks have historically been associated with contamination in the Northern Area of the Platteville Aquifer. There are no drinking water wells in this aquifer in the Northern Area and thus human exposure to contamination is limited.

Bedrock Valley discharge to St. Peter

3.2.2.2 Compliance with ARARs

Not Applicable

Water quality data presented in the Platteville Aquifer Northern Area Hydrogeologic Investigation Report (City of St. Louis Park, 1992) indicate total PAH concentrations that exceed drinking water criteria by as much as one to two orders of magnitude or more. However, the Platteville Aquifer is not used as a source of drinking water in the Northern Area of St. Louis Park and likely not in surrounding communities.

TABLE 3-1

Summary of Detailed Evaluation Criteria

Criteria		Issues
Overall Protection of Human Health and the Environment	-	Protection of human health and the environment
Compliance with ARARs	-	Compliance with Chemical-specific ARARs
	-	Compliance with action-specific ARARs
	-	Compliance with location-specific ARARs
	-	Compliance with other criteria, advisories, and guidance
Long-Term Effectiveness and Performance	-	Magnitude of residual risk
	-	Adequacy and reliability of controls
Reduction of Toxicity, Mobility, and Volume Through Treatment	-	Treatment process used and materials treated
	-	Amount of hazardous materials destroyed or treated
	-	Degree of expected reductions in toxicity, mobility, and volume
	-	Degree to which treatment is irreversible
	-	Type and quantity of residuals remaining after treatment
Short-Term Effectiveness	-	Protection of community during remedial actions
	-	Protection of workers during remedial actions
	-	Environmental impacts
	-	Time until remedial action objectives are achieved
Implementability	-	Ability to construct and operate the technology
	-	Reliability of the technology
	-	Ease of undertaking additional remedial actions, if necessary
	-	Ability to monitor effectiveness of remedy
	-	Ability to obtain approval from other agencies
	-	Coordination with other agencies
	-	Availability of off-site treatment, storage, and disposal services and capacities
	-	Availability of necessary equipment and specialists
	-	Availability of prospective technologies
Cost	-	Initial costs
	-	Operating and maintenance costs
	-	Present worth costs
State Acceptance[1]	-	State acceptance of preferred alternative
Community Acceptance[1]	-	Community acceptance of preferred alternative

1. State and community acceptance criteria are addressed in the Record of Decision following public comment on the Feasibility Study

3.2.2.3 Long Term Effectiveness and Permanence

Contam. of St Peter would not provide long term effec

Based on their relatively large volume and low mobility, residual PAH are expected to remain in the aquifer for at least the 30-year life of the CD-RAP. The potential risks posed by the residual contamination in the aquifer are very small because of the lack of a human exposure pathway, and because the relatively low mobility of the PAH compounds will reduce their tendency to migrate.

3.2.2.4 Reduction of Toxicity, Mobility or Volume Through Treatment

Because no treatment is included in this alternative, no reduction in toxicity, mobility or volume of contaminants would be achieved, except due to natural processes.

3.2.2.5 Short Term Effectiveness

Because no remedial action would be constructed or implemented, this criterion is not applicable.

3.2.2.6 Implementability

Because no remedial action would be constructed or implemented, this criterion is not applicable.

3.2.2.7 Costs

Because no remedial action would be constructed or implemented, no costs would be incurred.

3.3 Alternative 2: Gradient Control Wells

3.3.1 Detailed Description

This alternative consists of installing four gradient control wells on the eastern edge of the Northern Area, as shown in Figure 3-1. The wells would be six-inches or larger in diameter and open to the Platteville Aquifer. Doubling the size of the well diameter would increase the specific capacity of the well by about ten percent. The discharge from the wells will initially be routed to the sanitary sewer. The discharge will be monitored to determine if treatment is necessary to route the discharge to a storm sewer within approximately three to five years. Included in this

NON-RESPONSIVE

[redacted]

N

[redacted]d Engineering

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alternative is continued water level and water quality monitoring to assess the impacts of these gradient control wells on the Northern Area of the Platteville Aquifer.

3.3.2 Detailed Analysis

3.3.2.1 Overall Protection of Human Health and the Environment

This alternative would provide limited protection of human health and the environment by limiting the further spread of contaminants from the Northern Area Platteville Aquifer. The protection is only limited because the capture zones are limited in size, and the majority of groundwater in the aquifer would continue to flow from the Northern Area to the east.

3.3.2.2 Compliance with ARARs

Applicable or relevant and appropriate requirements for this alternative are defined in the CD-RAP, Sections 2.2 and 2.5:

DRINKING WATER CRITERIA

Parameter	Advisory Level	Drinking Water Criterion
The sum of benzo(a)pyrene and dibenz(a,h)anthracene	3.0 ng/l*	5.6 ng/l*
Carcinogenic PAH	15 ng/l	28 ng/l
Other PAH	175 ug/l	280 ng/l

*Or the lowest concentration that can be quantified, whichever is greater.

Since drinking water criteria for PAHs were not developed through the Safe Drinking Water Act regulations, it was necessary to develop these criteria for PAH compounds. This was accomplished through consultations with experts, MDH, MPCA, and U.S. EPA Drinking Water Program representatives (U.S. EPA, 1986). The drinking water criteria for carcinogenic PAH represents a risk level of 10^{-6}. The Platteville Aquifer is not used as a source of drinking water in the Northern Area of St. Louis Park and likely not in surrounding communities.

The CWA and the regulations under it are applicable to the proposed remedial activities with respect to the discharge of extracted ground water, or contaminated surface water from the Site, to either the surface waters or the sanitary sewers. The CWA and its regulations set forth permitting requirements for point source discharges that implement minimum treatment technology standards and protect the quality of the receiving water. The conditions in the CD-RAP are intended to require full compliance with the CWA with regard to National Pollutant Discharge Elimination System (NPDES) permitting and pretreatment requirements.

The operation of the Platteville Aquifer gradient control wells will be governed by the use of these ARARs or other limits established by the Agencies. The Platteville Aquifer has the beneficial use of recharging surface water, therefore, the surface water criteria may be used to assess the need for ground water control measures and discharge options for ground water that is removed.

SURFACE WATER CRITERIA

Parameter	Daily Maximum Concentration	30-Day Average Concentration
Carcinogenic PAH	--	65 ng/l
Other PAH	34 ug/l	17 ug/l
Phenanthrene	2 ug/l	1 ug/l
Phenols	--	10 ug/l

3.3.2.3 Long Term Effectiveness and Permanence

Pumping the four gradient control wells will not be entirely effective in preventing the further spread of contamination, but can be used to reduce or limit the further spread of contamination and mitigate the impacts of contamination. The effectiveness of these wells would be very limited based on the size of their capture zones. The variable transmissivity in this area (over two orders of magnitude variability) precludes an accurate prediction of capture zones for the four wells. Where the transmissivity is lowest (in the northern portion) pumping rates as low as 5 to 10 gallons per minute are not sustainable, and the resulting capture zones would be only a few feet wide. On the other hand, the southernmost well is adjacent to well W428 which has shown a relatively high transmissivity in short-term aquifer tests. The calculated capture zone of this location (approximately 5000 feet at a pumping rate of approximately 200 gallons per minute) is unrealistic because the extent of the high transmissive zone is much less than 5000 feet, and it is not known if the short-term test results are applicable to a permanent pumping activity.

Residual levels of PAH will remain in the aquifer. Based on their relatively large volume and low mobility, residual PAH are expected to remain in the aquifer for at least the 30-year life of the CD-RAP. Pumping will continue as long as it is necessary to attempt to prevent the further spread of contamination. The potential risks posed by residual contamination in the aquifer after plume management activities are concluded are very small because of the lack of a human exposure pathway, and because the relatively low mobility of the PAH compounds will reduce their tendency to migrate.

Discharge from the pumping would initially be routed through the sanitary sewer for treatment by the MWCC. The discharge can then be routed to the storm sewer or surface water discharge provided that all effluent limitations set by the CD-RAP or NPDES permits are met. To reach the effluent limitations, the discharge may be treated using activated carbon. When the activated carbon is no longer effective to treating the discharge, it will be replaced with new activated carbon. The spent carbon will then become a treatment residual and would be disposed of in conjunction with spent carbon generated at the Drift-Platteville Aquifer source control wells treatment facility, and the SLP10/15 drinking water treatment plant. Spent carbon from the SLP10/15 drinking water treatment plant has been evaluated for acute toxicity by the City, under guidance provided by the MPCA Hazardous Waste Division, and was found not to be toxic. The carbon generated from other plants treating gradient control water is expected to be similar. Therefore, no significant additional risk from spent carbon is anticipated.

The pumping technology for this alternative is standard, reliable, and a proven technology for meeting project objectives. System components may require replacement during the life of this remedial action, but replacement should be a straightforward procedure. The City of St. Louis Park has been operating and maintaining ground water pumping systems for over 40 years, thus no problems with the adequacy or reliability of controls is anticipated.

3.3.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The most important feature of this alternative is the control exerted by the pumping well(s) on the volume and mobility of contaminants within the aquifer. During the course of pumping, the more mobile PAH will be removed first, leaving less mobile PAH in the aquifer.

Treatment of pumped water is not a principal element of this alternative, and would only destroy a relatively small portion of the total volume of contamination.

3.3.2.5 Short Term Effectiveness

The construction and implementation phase of this alternative presents minimal worker exposure and community exposure, and will not cause adverse environmental impacts. During the short construction project, the wells will be constructed, and well houses will be built and well pumps will be installed. The further spread of contamination in the capture zone of the pumping well(s) will be halted within a matter of days, however, the captive zones cover only a small fraction of the aquifer area. Therefore, there will be a relatively short time period in which short-term effectiveness can be assessed.

The need for additional response actions in the Northern Area of the Platteville Aquifer will be addressed based on future ground water monitoring results. Monitoring of available wells completed in the Platteville Aquifer is ongoing.

3.3.2.6 Implementability

however, it can be done

The heterogeneous and low transmissive nature of the Platteville Aquifer creates very difficult conditions for siting new well locations in the Northern Area. The technology for pumping ground water is reliable, and easy to maintain. There should be little potential for schedule delays, or conflicts with other remedial actions taken at the Site. Repair work on system components will be similarly straightforward. Ground water monitoring, and monitoring the discharge from the pumping wells, will provide an adequate means of assessing exposure pathways. There would be little risk of human exposure to PAH compounds in the Northern Area of the Platteville Aquifer, if monitoring is insufficient to detect failure of the gradient control well system. ?

~~Administrative agencies are not expected to present infeasible implementation problems.~~ The same remedial actions are currently being practiced elsewhere at the Reilly Site. Other agencies such as the Metropolitan Waste Control Commission, Minnesota Department of Natural Resources, and/or Minnehaha Creek Watershed District have a precedent to follow in dealing with this activity. and . it is expected that these agencies will concur with the proposed rem action

Services and materials for this work are all available at competitive bid prices, and will not limit the implementability of this alternative.

3.3.2.7 Costs

Project costs are dependent on the total volume and quality of water that needs to be pumped. Based on prior experience at the Reilly Site, capital costs for equipment, installation, engineering, permits, startup, and contingencies are estimated at $400,000 (assuming four wells are installed). If a treatment facility is required for a surface water disposal option, the capital cost of the facility is estimated at $500,000. Annual O&M costs are reduced for this alternative because of the many other operating wells that are currently cared for by the City of St. Louis Park. O&M, materials, energy, disposal of residues, purchased services, administrative costs, and other post-construction costs that may be required to ensure the effectiveness of this remedial action are estimated at no more than $120,000 per year. Major components of the annual O&M costs include:

sewer charge	$32,000	one time?
electricity	$ 8,000	
labor	$80,000	

If major equipment problems occur, and replacement is required at some time during the first thirty years of operation, then two to four weeks should be sufficient to correct the problem. Given the relatively slow velocity of ground water travel, no costs for any other remedial actions are included in the above estimates to prevent exposure to contaminants.

No cost sensitivity analysis was performed due to the low uncertainty of overall project costs.

3.4 Alternative 3: Extraction Well

3.4.1 Detailed Description

The Drift-Platteville Aquifer Northern Area Supplemental Remedial Investigation (City of St. Louis Park, 1991) identified the use of Platteville Aquifer well W434 as a pumping well to effectively intercept ground water contaminants from migrating into the area of the buried bedrock valley downgradient from the Northern Area. Well W434 is ideally located to protect the St. Peter Aquifer by pumping the Platteville Aquifer. In this manner, pumping well W434 will address the primary concern for limiting the further spread of contamination located in the Northern Area of the Platteville Aquifer. Pumping well W434 will not prevent the further spread of contaminants located within the Northern Area because contaminants must migrate through the Northern Area and move downgradient before reaching well W434.

Based on the prior aquifer test (well W434 was pumped at 30 gallons per minute for 24 hours) a long-term pumping rate of 20 to 30 gallons per minute is expected to develop a capture area sufficient to protect the buried bedrock valley.

The discharge from the well will initially be routed to the sanitary sewer. The discharge will be monitored to determine if treatment is necessary to route the discharge to a storm water sewer within approximately three to five years. Included in this alternative is continued water level and water quality monitoring to assess the impacts of this gradient control well on the Northern Area of the Platteville Aquifer.

3.4.2 Detailed Analysis

3.4.2.1 Overall Protection of Human Health and the Environment

Based on the long history of the contamination problem, and on the relatively low mobility of the contaminants, the contaminants have probably already spread to their maximum extent in the Northern Area, and there appears to be few uncontaminated portions of the Northern Area of the Platteville Aquifer. No human health risks have historically been associated with contamination in the Northern Area of the Platteville Aquifer. There are no drinking water wells in this aquifer in the Northern Area and thus human exposure to the contamination is limited.

This alternative provides overall protection of human health and the environment by limiting the further spread of contamination within the aquifer. The primary function of operating well W434 is to eliminate the migration pathway through the buried bedrock valley that may result in human exposure. By limiting the further spread of contamination into the buried bedrock valley, greater overall protection will be achieved.

3.4.2.2 Compliance with ARARs

Applicable or relevant and appropriate requirements for this alternative are defined in the CD-RAP, Sections 2.2 and 2.5:

DRINKING WATER CRITERIA

Parameter	Advisory Level	Drinking Water Criterion
The sum of benzo(a)pyrene and dibenz(a,h)anthracene	3.0 ng/l*	5.6 ng/l*
Carcinogenic PAH	15 ng/l	28 ng/l

DRINKING WATER CRITERIA

Parameter	Advisory Level	Drinking Water Criterion
Other PAH	175 ug/l	280 ng/l

*Or the lowest concentration that can be quantified, whichever is greater.

Since drinking water criteria for PAHs were not developed through the Safe Drinking Water Act regulations, it was necessary to develop these criteria for PAH compounds. This was accomplished through consultations with experts, MDH, MPCA, and U.S. EPA Drinking Water Program representatives (U.S. EPA, 1986). The drinking water criteria for carcinogenic PAH represents a risk level of 10^{-6}. The Platteville Aquifer is not used as a source of drinking water in the Northern Area of St. Louis Park and likely not in surrounding communities. St Peter SLP 3 or other common dowagr

SURFACE WATER CRITERIA

Parameter	Daily Maximum Concentration	30-Day Average Concentration
Carcinogenic PAH	–	65 ng/l
Other PAH	34 ug/l	17 ug/l
Phenanthrene	2 ug/l	1 ug/l
Phenols	–	10 ug/l

The CWA and the regulations under it are applicable to the proposed remedial activities with respect to the discharge of extracted ground water, or contaminated surface water from the Site, to either the surface waters or the sanitary sewers. The CWA and its regulations set forth permitting requirements for point source discharges that implement minimum treatment technology standards and protect the quality of the receiving water. The conditions in the CD-RAP are intended to require full compliance with the CWA with regard to National Pollutant Discharge Elimination System (NPDES) permitting and pretreatment requirements.

The operation of the Platteville Aquifer gradient control well will be governed by the use of these ARARs or other limits established by the Agencies. The Platteville Aquifer has the beneficial use of recharging surface water, therefore, the surface water criteria may be used to assess the need for ground water control measures and discharge options for ground water that is removed.

3.4.2.3 Long Term Effectiveness and Permanence

Pumping will not be effective in preventing the further spread of contamination, but can be used to reduce or limit the further spread of contamination and mitigate the impacts of contamination. Once the response objective is met, and the further spread of contamination has been reduced, residual levels of PAH will remain in the aquifer. Based on their relatively large volume and low mobility, residual PAH are expected to remain in the aquifer for at least the 30-year life of the CD-RAP. Pumping will continue as long as it is necessary to prevent the further spread of contamination. The potential risks posed by residual contamination in the aquifer after plume management activities are concluded are very small because of the lack of a human exposure pathway, and because the relatively low mobility of the PAH compounds will reduce their tendency to migrate.

Discharge from the pumping would initially be routed through the sanitary sewer for treatment by the MWCC. The discharge can then be routed to the storm sewer or surface water discharge provided that all effluent limitations set by the CD-RAP or NPDES permits are met. To reach the effluent limitations, the discharge may be treated using activated carbon. When the activated carbon is no longer effective to treating the discharge, it will be replaced with new activated carbon. The spent carbon will then become a treatment residual and would be disposed of in conjunction with spent carbon generated at the Drift-Platteville Aquifer source control wells treatment facility, and the SLP10/15 drinking water treatment plant. Spent carbon from the SLP10/15 drinking water treatment plant has been evaluated for acute toxicity by the City, under guidance provided by the MPCA Hazardous Waste Division, and was found not to be toxic. The carbon generated from other plants treating gradient control water is expected to be similar. Therefore, no significant additional risk from spent carbon is anticipated.

The pumping technology for this alternative is standard, reliable, and a proven technology for meeting project objectives. System components may require replacement during the life of this remedial action, but replacement should be a straightforward procedure. The City of St. Louis Park has been operating and maintaining ground water pumping systems for over 40 years, thus no problems with the adequacy or reliability of controls is anticipated.

3.4.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

? The most important feature of this alternative is the control exerted by the pumping well on the volume and mobility of contaminants within the aquifer. During the course of pumping, the more mobile PAH will be removed first, leaving less mobile PAH in the aquifer.

same com alt 2

Treat a * MWCC

Treatment of pumped water is not a principal element of this alternative, and would only destroy a relatively small portion of the total volume of contamination.

3.4.2.5 Short Term Effectiveness

The construction and implementation phase of this alternative does not present worker exposure or community exposure, and will not cause adverse environmental impacts. During the short construction project, a well house will be built and a well pump will be installed. The further spread of contamination in the capture zone of the pumping well will be halted within a matter of days. Therefore, there will be a relatively short time period in which short-term effectiveness can be assessed.

The need for additional response actions in the Northern Area of the Platteville Aquifer will be addressed based on future ground water monitoring results. Monitoring of available wells completed in the Platteville Aquifer is ongoing.

3.4.2.6 Implementability

Well W434 is already constructed and has been tested; therefore, there are no implementation problems associated with that well. The ~~heterogeneous and low transmissive~~ nature of the Platteville Aquifer ~~creates very difficult conditions for siting new~~ well locations in the Northern ~~Area. T~~he technology for pumping ground water is reliable, and easy to maintain. There should be little potential for schedule delays, or conflicts with other remedial actions taken at the Site. Repair work on system components will be similarly straightforward. Ground water monitoring, and monitoring the discharge from the pumping wells, will provide an adequate means of assessing exposure pathways. There would be little risk of human exposure to PAH compounds in the Northern Area of the Platteville Aquifer, if monitoring is insufficient to detect failure of the gradient control well system. ?

~~Administrative~~ agencies ~~are not expected to present infeasible implementation problems~~. The same remedial actions are currently being practiced elsewhere at the Reilly Site. Other agencies such as the Metropolitan Waste Control Commission, Minnesota Department of Natural Resources, and/or Minnehaha Creek Watershed District have a precedent to follow in dealing with this activity. Same comment as before

Services and materials for this work are all available at competitive bid prices, and will not limit the implementability of this alternative.

3.4.2.7 Costs

Project costs are dependent on the total volume and quality of water that needs to be pumped. Based on prior experience at the Reilly Site, capital costs for equipment, installation, engineering, permits, startup, and contingencies are estimated at $100,000 (assuming only well W434 is pumped). If a treatment facility is required for a surface water disposal option, the capital cost of the facility is estimated at $500,000. Annual O&M costs are reduced for this alternative because of the many other operating wells that are currently cared for by the City of St. Louis Park. O&M, materials, energy, disposal of residues, purchased services, administrative costs, and other post-construction costs that may be required to ensure the effectiveness of this remedial action are estimated at no more than $30,000 per year. Major components of the annual O&M costs include:

sewer charge	$8,000
electricity	$ 2,000
labor	$20,000

If major equipment problems occur, and replacement is required at some time during the first thirty years of operation, then two to four weeks should be sufficient to correct the problem. Given the relatively slow velocity of ground water travel, no costs for any other remedial actions are included in the above estimates to prevent exposure to contaminants.

No cost sensitivity analysis was performed due to the low uncertainty of overall project costs.

3.5 Comparative Analysis

3.5.1 Overall Protection of Human Health and the Environment

Alternative 3, Extraction Well, would be the most protective of human health and the environment, as it would limit migration pathways that may result in human exposure by intercepting groundwater contaminants from the Platteville Aquifer before they enter the St. Peter Aquifer. This would mitigate any further spread of contaminants in the Northern Area.

Alternative 2, Gradient Control Wells, would be second in protectiveness. Migration of some contamination would be prevented, although, due to the small capture zones of the wells, the majority of contaminants migrating in the aquifer would move past the wells, out of the Northern Area.

Alternative 1, No Action, would be the least protective, as no remedial actions would be implemented.

3.5.2 Compliance with ARARs

Control the spread of contam from this area

Drinking water criteria for PAHs (as presented in Section 1.4) would not likely be achieved for groundwater in the Platteville Aquifer Northern Area by any of the three alternatives. The low transmissivity of the aquifer, together with the large volume and low mobility of the PAHs, make removal of PAHs very difficult, especially down to ppb or ppt levels.

Achievement of surface water criteria would be achieved for the two alternatives that include groundwater pumping. If necessary, carbon adsorption treatment would be used to ensure that these criterias were achieved.

3.5.3 Long Term Effectiveness and Permanence

3 may be more

Pumping of groundwater through an extraction well (Alternative 3) or gradient control wells (Alternative 2) will not remove all PAH from the Platteville Aquifer Northern Area. However, the potential risks posed by any residual contamination in the aquifer would be very small, due to the lack of a human exposure pathway and the low mobility of the PAH. Therefore, Alternatives 2 and 3 would be approximately equal as far as long term effectiveness and permanence is concerned. Alternative 1, No Action, would be slightly less effective over the long term, as no PAHs would be removed by pumping.

3.5.4 Reduction of Toxicity, Mobility or Volume Through Treatment

Treatment of groundwater removed from the aquifer is not a principal element of any of the alternatives, and only a small volume of the PAHs present would be destroyed (thereby reducing their toxicity). Alternatives 2 and 3, which do include treatment by carbon adsorption (and subsequent thermal treatment during carbon regeneration) would, however, reduce the volume and toxicity of PAHs more than Alternative 1, No Action.

Mobility reduced by 2 + 3

3.5.5 Short Term Effectiveness

Potential risks to the environment, community and on Site workers would be minimal for Alternatives 2 and 3, and nonexistent for Alternative 1. Alternative 2, which includes installation of four groundwater extraction wells, pumps, and well houses would have slightly higher associated risks than Alternative 3, which includes installation of one pump and well house only, although potential risks for both would be minimal.

3.5.6 Implementability

The No Action alternative obviously has no implementability limits as no remedial action would be taken.

Alternative 3, Extraction Well, would have minimal implementability considerations, as well W434 is already constructed and has been tested. No problems are anticipated in installing the pump, and constructing the well house and discharge line.

Alternative 2, Gradient Control Well, would be the most difficult of the three alternatives to implement. The heterogeneous and low transmissive nature of the Platteville Aquifer creates very different conditions for siting new well locations in the Northern Area. In addition, constructing discharge pipes from the four wells to the POTW and storm sewer would be more difficult than constructing a single such line for Alternative 3.

3.5.7 Cost

Alternative 2 would be the highest cost alternative, followed by Alternative 3 and then Alternative 1. Based on prior experience at the Reilly Site, capital costs for installation, equipment, engineering, permits, startup and contingencies are estimated at $100,000 for each extraction well. If a carbon adsorption treatment facility is required, the estimated cost is $500,000.

Therefore, the cost for Alternative 2, which includes four groundwater extraction wells would range from $400,000 to $900,000, depending on whether or not a treatment facility is required. O&M costs would be approximately $120,000 per year, again, depending on whether or not a treatment facility is required.

Alternative 3, consisting of one well, would have a capital cost of $100,000 to $600,000, and annual O&M costs of approximately $30,000.

4.0 RECOMMENDED ALTERNATIVE

The use of gradient control wells to limit the spread of contamination is identified in the CD-RAP as the primary remedial action in several aquifers in the vicinity of the Reilly Site. Gradient control provides overall protection by controlling ground water flow and preventing the further spread of contaminants.

In the Northern Area of the Platteville Aquifer, hydrogeologic conditions are unfavorable for the successful use of gradient control wells. However, pumping downgradient well W434 will mitigate the migration of contamination from the Northern Area by intercepting contaminants before they enter the buried bedrock valley (thus protecting the St. Peter Aquifer). In combination with continued ground water monitoring, and a new pumping well in the Drift Aquifer, overall protection of human health and the environment will be achieved. The discharge from the gradient control well will meet applicable requirements. This alternative is straightforward to implement and, in the long-term, operations of gradient control well W434 will reduce the amount of PAH present in the Platteville Aquifer.